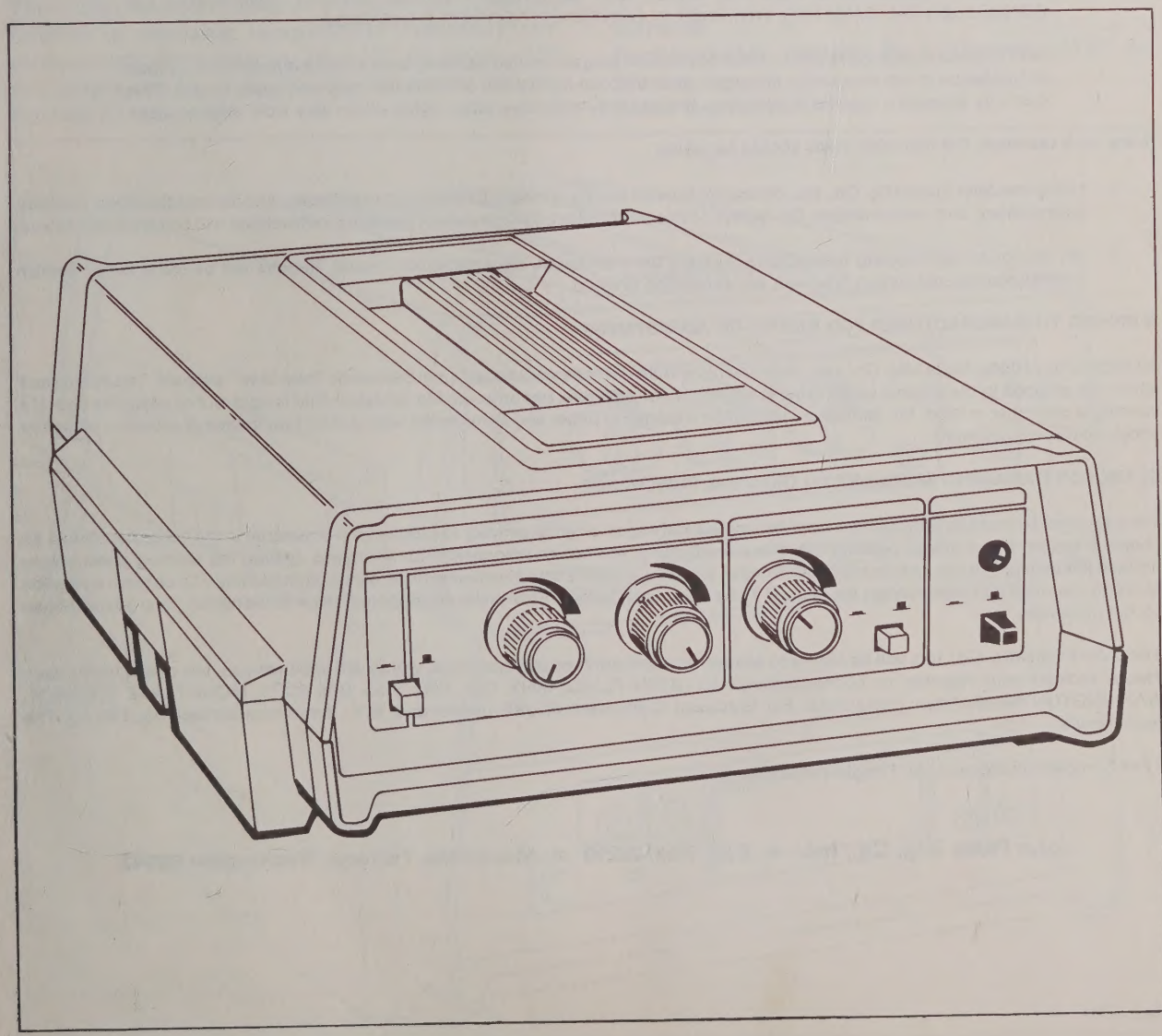
FLUKE®

Instruction Manual

Model Y2003

Calibrator



P/N 489260 June 1978

Y2003

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The JOHN FLUKE MFG. CO., INC., warrants each instrument it manufactures to be free from defects in material and workmanship under normal use and service for the period of one year from date of purchase. This warranty extends only to the original purchaser. This warranty shall not apply to fuses, disposable batteries (rechargeable type batteries are warranted for 90 days), or any product or parts which have been subject to misuse, neglect, accident or abnormal conditions of operations.

In the event of failure of a product covered by this warranty, John Fluke Mfg. Co., Inc., will repair and calibrate an instrument returned to an authorized Service Facility within one year of the original purchase; provided the warrantor's examination discloses to its satisfaction that the product was defective. The warrantor may, at its option, replace the product in lieu of repair. With regard to any instrument returned within one year of the original purchase, said repairs or replacement will be made without charge. If the fault has been caused by misuse, neglect, accident or abnormal conditions of operations, repairs will be billed at a nominal cost. In such case, an estimate will be submitted before work is started, if requested.

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2. On receipt of the shipping instructions, forward the instrument, transportation prepaid. Repairs will be made at the Service Facility and the instrument returned, transportation prepaid.

SHIPPING TO MANUFACTURER FOR REPAIR OR ADJUSTMENT

All shipments of John Fluke Mfg. Co., Inc., instruments should be made via United Parcel Service or "Best Way*" prepaid. The instrument should be shipped in the original packing carton; or if it is not available, use any suitable container that is rigid and of adequate size. If a substitute container is used, the instrument should be wrapped in paper and surrounded with at least four inches of excelsior or similar shock-absorbing material.

CLAIM FOR DAMAGE IN SHIPMENT TO ORIGINAL PURCHASER

The instrument should be thoroughly inspected immediately upon original delivery to purchaser. All material in the container should be checked against the enclosed packing list. The manufacturer will not be responsible for shortages against the packing sheet unless notified immediately. If the instrument is damaged in any way, a claim should be filed with the carrier immediately. (To obtain a quotation to repair shipment damage, contact the nearest Fluke Technical Center.) Final claim and negotiations with the carrier must be completed by the customer.

The John Fluke Mfg. Co., Inc. will be happy to answer all application or use questions, which will enhance your use of this instrument. Please address your requests or correspondence to: JOHN FLUKE MFG. CO., INC., P.O. Box 43210, MOUNTLAKE TERRACE, WASHINGTON 98043, Atten: Sales Dept. For European Customers: FLUKE (Nederland) B.V., Zevenheuvelenweg 53, Tilburg, The Netherlands.

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John Fluke Mfg. Co., Inc. • P.O. Box 43210 • Mountlake Terrace, Washington 98043

Rev. 12/77

INTRODUCTION

The Model Y2003 is a thermocouple simulator and a battery pack. It is designed to be used with the Model 2190A as a portable thermocouple thermometer calibrator (see Figure 1). It can simulate all of the seven thermocouples available on the 2190A over their full temperature range. The Y2003's calibration voltage may be varied from –10 to +90 mV dc using the front panel coarse and fine potentiometers. The third front panel potentiometer, OFFSET ADJUST, will add (when enabled) and additional 0 to 10° change in the calibration voltage which is ideal for checking the linearity and response of an external strip chart recorder or analog meter.

The Y2003 has been designed to allow the 2190A to become a portable temperature reference for thermocouple thermometers. Its +12V dc output, 750 mA output can be used with any instrument with an external 12 volt input.

SPECIFICATIONS

Electrical

Compatible Thermocouples: J, K, E, R, S, T and *C (*not an ANSI symbol).
Operating Range °C °F: Same as 2190A (see specifications in 2190A manual).
Operating Power: +12V dc (supplied by internal rechargeable battery pack).
Input Connections: Screw terminals on +12V dc connector.
Offset Correction: Uncalibrated DC output, manually variable (simulates a 0 to 10°C change in temperature). (Dependent on thermocouple selected.)
Output Impedance: 100Ω.
Range: –10 to +90 mV dc, 25°C.
Stability: 20 ppm/°C, from 25°C.

General

Rechargeable Battery Pack Output: +12V dc, 750 mA max.
Rated Capacity: 2.2 Amp hours.

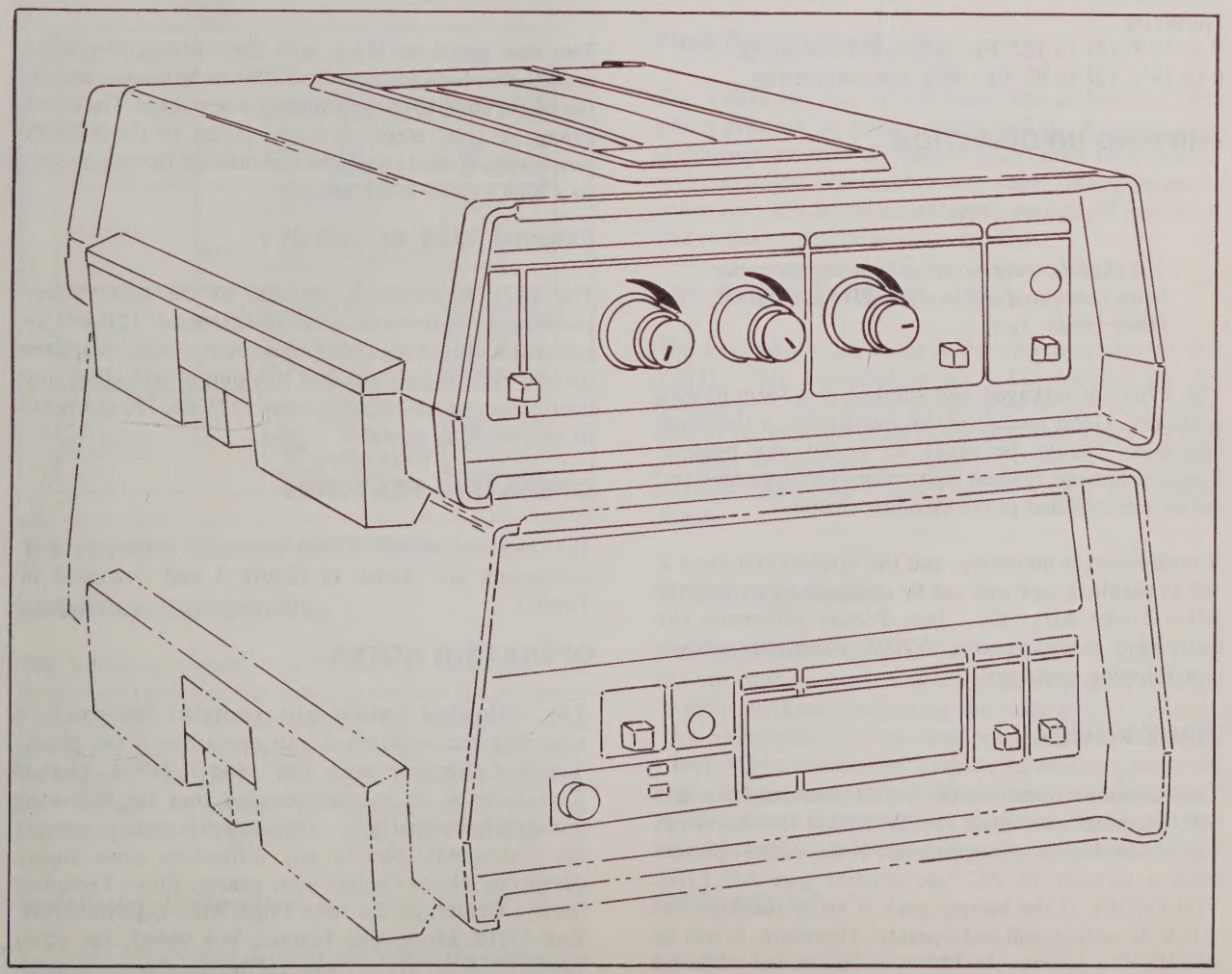


Figure 1. Y2003/2190A

Battery Type: 10, Ni-cad 1/2 D size cells (fully encapsulated in a drip-proof case).
Operating Time: 5 to 6 hours typical at 25°C on full charge when used in conjunction with the 2190A.
Recharge Time: 16 hours typical at 25°C.
Battery Charger: Internal, with automatic low battery cut off circuit.
Output Connectors: Rear panel screw terminal block.
Power Requirements: Switch selectable for 100, 120, 200 or 240 volts ac ±10%, 50 to 400 Hz.
B Size (PTI): 8.20 cm H x 20.45 cm W x 32.64 cm D. (2.25 in H x 8.05 in W x 12.85 in D).
Weight: 2.47 kg. 5 lb. 7 oz.
Fuse Type:
AC Line, 100/120V 1/8 amp, slo-blo, 250 MDL.
AC Line, 200/240V 1/16 amp, slo-blo, 250 MDL.
DC Output, 12V 3/4 amp, slo-blo, 250 MDL.

Environmental

Operating/Storage Temperature: 0 to 40°C.
Shock and Vibration: Meets requirements of MIL standard 810.
Humidity
0 to 40°C (32 to 122°F) - 80% non-condensing.
0 to 35°C (32 to 95°F) - 90% non-condensing.

SHIPPING INFORMATION

NOTE

For the following paragraph the thermometer being calibrated will be referred to as the UUT (Unit Under Test).

The Y2003 is packaged and shipped in a foam packed container. Upon receipt of the instrument, a thorough inspection should be made to reveal any possible shipping damage. Special instructions for inspection and claims are included in the shipping carton.

If reshipment is necessary, and the original container is not available, a new one can be obtained by writing the John Fluke Mfg. Co., Inc. Please reference the instrument model number (Y2003) when requesting a new shipping container.

INPUT POWER

The calibrator circuit on the Y2003 operates from ±15 Vdc, supplied to it from the 2190A via the Accessory Cable. The battery charger circuit of the Y2003 operates from a number of AC line sources (see AC LINE VOLTAGE). If the battery pack is being recharged its +12V dc output will not operate. Therefore, it will be necessary to connect the 2190A to line power while the Y2003's battery pack is being recharged.

NOTE

If the Y2003's accessory cable is not connected to the 2190A the calibrator will not operate, the +12V dc output will, however, remain operational.

AC Line Voltage

The Y2003 may be charged from one of four switch selectable ac line voltages. These are: 100, 120, 200 and 240V ac ±10%, 50 to 400 Hz. The source selecting switches are located on the Y2003's Main PCB and may be accessed by removing the Y2003's top cover, see Figure 2. Figure 2 also indicates all possible switch positions for the compatible charging voltages. Before connecting the Y2003 to the ac line, check to ensure that the instrument is wired to accomodate the local line voltage. A decal on the rear of the Y2003 defines the particular line voltage from which it has been factory selected to charge.

The rear panel ac input is a three-prong, U-ground receptacle which permits the Y2003 to be connected, via the power cord, to the appropriate line voltage. The offset prong on this receptacle is connected to the Y2003's power supply, and should be tied through the power cord to a high quality earth ground.

External +12V dc Output

The +12V dc output is provided on the Y2003's rear panel via a two screw terminal block labeled "12V dc". To access this output use a #18 two connector wire. When the battery pack is fully charged this output will allow any instrument, which operates from +12V dc, 750 mA max, to become fully portable.

OPERATING FEATURES

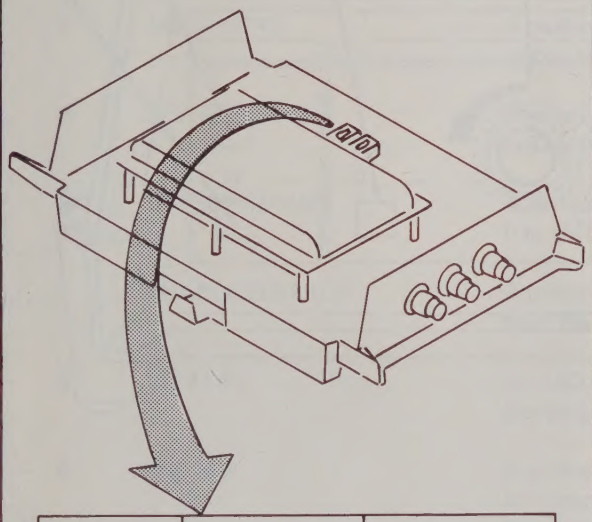
The location of all Y2003 controls, indicators and connectors are shown in Figure 3 and described in Table 1.

OPERATING NOTES

The following paragraphs contains information regarding the installation and operation of the Model Y2003 Calibrator with the Model 2190A Digital Thermometer. It is recommended that the following paragraphs be read before any attempt is made to operate the instrument. Should any difficulties arise during operation, please contact your nearest Fluke Technical Service Center, or the John Fluke Mfg. Co., Inc., P.O. Box 43210, Mountlake Terrace, WA 98043; Tel, (206) 774-2211. A list of the Technical Service Centers is given at the rear of this manual.

NOTE

To select line voltage place slot on each switch toward corresponding number on pcb; 100, 120, 200 or 240.



VOLTAGE	S2	S5
100V	SLOT 240 200 100 120	SLOT 100 200 120 240
120V	SLOT 240 200 100 120	SLOT
240V	SLOT 240 200 100 120	SLOT 100 200 120 240
200V	SLOT 240 200 100 120	SLOT 100 200 120 240

Figure 2. Source Selection

Installation Compatibility

The Y2003 is housed in a B size PTI (Portable Test Instrument) case and has only two outputs; the accessory cable and the +12V dc output. The accessory cable carries the calibration voltage and may be connected to the Model 2190A ONLY. The +12V dc output, however, may be used to provide portable operation for any instrument that is compatible with +12V dc, 750 mA max.

Installation Calibration

To connect the Y2003 to the Model 2190A for calibration purposes proceed as follows:

1. Connect the Y2003's Accessory Cable to the 2190A's Accessory Connector (see Figure 4). If portable operation is desired connect the Y2003's +12V dc output to the 2190A's +12V dc input using a #18 two connector copper wire.

2. Connect the proper thermocouple wire from the 2190A's input connector to the thermocouple input of the UUT.

NOTE

Accurate calibration will result only if the 2190A and the UUT have been programmed to accept the type of thermocouple wire actually being used. See Table 2 for thermocouple types, and ranges and the 2190A manual for 2190A's thermocouple selection procedure.

Fuse Replacement

The Y2003 has two in line fuses. The ac line fuse (F1) which protects the power supply and the dc output fuse (F2) which protects the battery pack. Both fuses may be accessed at the instrument's rear panel. When replacing either fuse, check the instrument's rear panel fuse decal and replace with the appropriate fuse.

Low Battery Indicator

The low battery indicator is the only indicator on the Y2003. This indicator is an LED located on the instrument's front panel which lights to indicate that the battery pack needs to be recharged. This indicator also provides a continuous battery discharge to prevent memory effect, see Theory of Operation for further details.

Offset Adjustment

The Y2003 provides an offset adjustment which allows the operator to check such things as strip chart recorder linearity without readjusting the main output controls. This adjustment is a ten-turn pot located on the front panel. When enabled its' output (depending upon what type of thermocouple the 2190A is using) will simulate a 0 to 10° change in the junction temperature of the 2190A (actual change depends on thermocouple selected).

OPERATION

Use the following procedures to operate the Model Y2003.

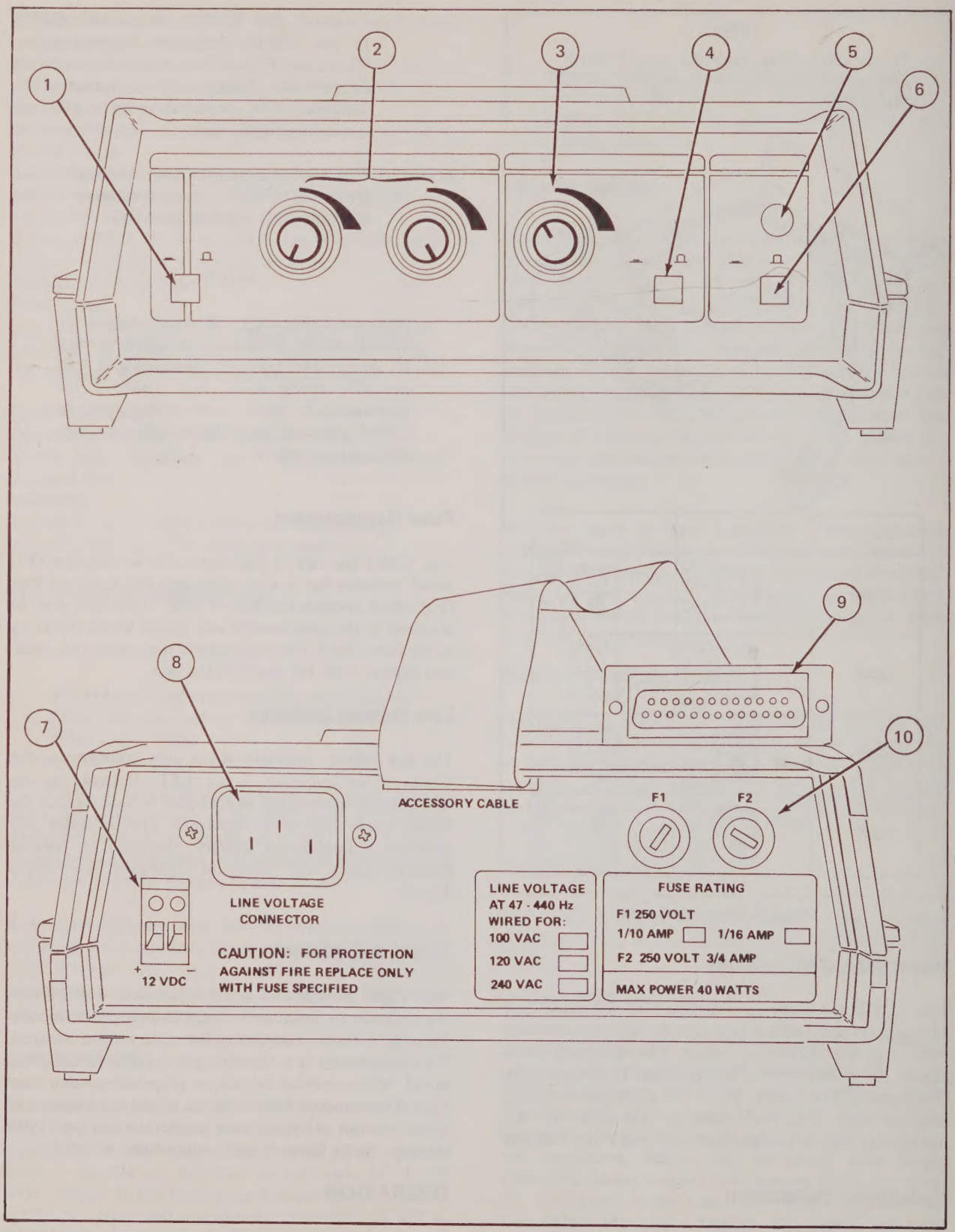


Figure 3. Controls, Indicators and Connectors

Table 1. Controls, Indicators and Connectors

ITEM NO.	NAME	FUNCTION
1	METER/CAL	A push-push button used to enable/disable the calibration voltage without affecting the +12V dc output, in = disable, out = enable.
2	COARSE, FINE	Two ten-turn potentiometers which together will vary the calibration voltage from −10 to +90 mV dc.
3	OFFSET ADJUST	A ten-turn potentiometer which when enabled will add an additional 0 to 50°C voltage change to the calibration voltage.
4	ENABLE/DISABLE	A push-push button which will add or remove the OFFSET voltage from the calibration voltage, in = enable, out = disable.
5	LO BTRY	An LED which lights to indicated that the battery pack requires charging.
6	ON/OFF	A push-push button which enables/disables the battery charger. In = charger enabled, +12V dc output disabled. Out = charger disabled, +12V dc output enabled.
7	12 VDC	A two terminal block which allows an external load to be connected to the Y2003 battery pack.
8	LINE VOLTAGE CONNECTOR	A three-prong receptacle which allows the Y2003 to be connected to a compatible line source.
9	Accessory Cable	A 32- pin output connector which carries the calibration voltage to the 2190A and the +15V operating voltage to the Y2003.
10	F1, F2	In line fuses, F1 is the ac line fuse, F2 is the battery pack fuse.

Calibration Operation

1. Connect the Y2003 to the 2190A using Installation Calibration procedure.
2. Place the Y2003's CHARGER POWER switch to the OFF position.
3. Energize the Model 2190A and the UUT, allow each to warm-up for the time specified in their respective instruction manuals.
4. Place the Y2003's METER/CAL switch to the CAL position and the OFFSET adjustment switch to the DISABLE position.
5. Adjust the Y2003's COARSE and FINE potentiometers until the desired temperature is displayed on the 2190A.
6. In order to calibrate the UUT over its full temperature range, first input a voltage corresponding to 0.0°C on the 2190A and adjust the UUT zero pot until the UUT reads 0.0°C. Next, input a voltage corresponding to the full scale temperature range of the UUT on the 2190A and adjust the UUT full scale pot for the proper full scale reading.
7. If it is necessary to apply a fixed offset at this calibration point, enable the OFFSET adjustment and adjust the offset potentiometer until the 2190's display changes to the desired temperature. After this adjustment is made, the selected OFFSET may be added or removed from the Y2003's calibration voltage by placing the OFFSET adjustment to its ENABLE or DISABLE position respectively.

NOTE

If the Y2003's calibration point is changed the OFFSET will have to be readjusted.

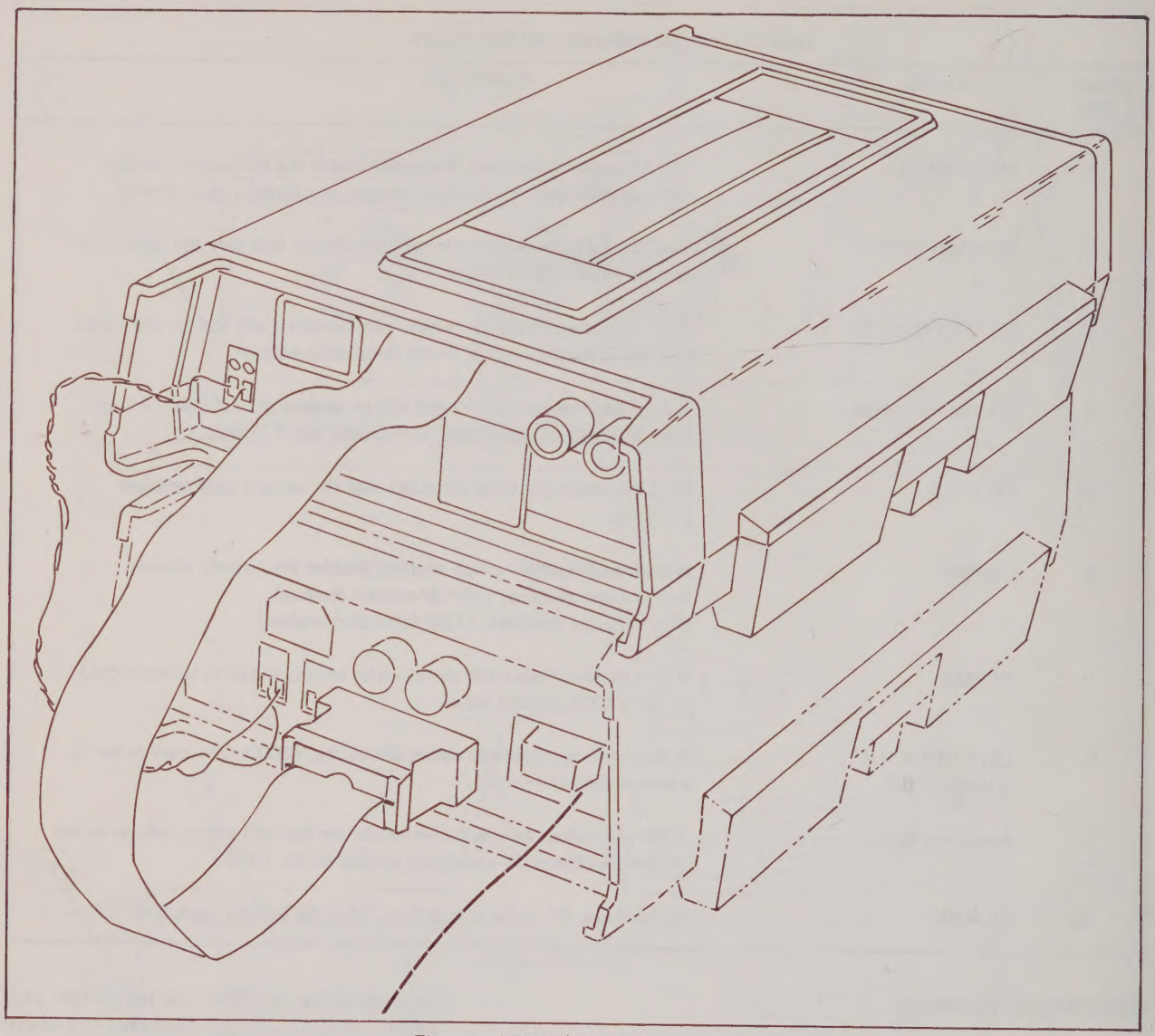


Figure 4. Y2003/2190A Connection

Battery Charge Operation

The following procedure will disconnect the Y2003's +12V dc output. If it is necessary to operate the 2190A while charging the Y2003 the 2190A must be connected to the line voltage. The Y2003 should be recharged whenever the LO BATTERY indicator comes on.

To charge the Y2003's, battery pack connect a compatible voltage source (see AC Line Voltage) to the Y2003's input connector and place the Y2003's front panel ON/OFF switch to the ON position. Allow the Y2003 to charge for typically 16 hours at 25°C.

NOTE

If the batteries have been discharged to a point below the forward drop of the LO BATTERY LED then the LED will not be on but the batteries will require charging.

THEORY OF OPERATION

The Model Y2003 consists of a stable voltage source, a power supply/battery charger and a battery pack. As shown in Figure 5, the stable voltage source is basically a precision divider network consisting of three potentiometers and a +15/–15V supply. The +15/–15 volt supply is input from the Model 2190A to two op

Table 2. Thermocouple Types and Ranges in °C

ANSI TYPE	ANSI COLOR CODE +	ANSI COLOR CODE −	THERMOCOUPLE MATERIAL	USABLE TEMPERATURE °C RANGE	ERROR LIMITS °F RANGE	APPROXIMATE EMF REFERRED TO ICE POINT
J	White	Red	Iron vs Constantan	−270° to +1200°	0° to +700°	0 to +50 mV
K	Yellow	Red	Chromel vs Alumel	−270° to +1372°	0° to +1260°	0 to +50 mV
T	Blue	Red	Copper vs Constantan	−270° to +400°	−184° to +371°	−5 to +20 mV
E	Violet	Red	Chromel vs Constantan	−670° to +1000°	0° to −871°	0 to +75 mV
R	*	*	Platinum vs Platinum 13% Rhodium	−50° to +1768°	0° to +1482°	0 to +18 mV
S	*	*	Platinum vs Platinum 10% Rhodium	−50° to +1768°	0° to +1482°	0 to +18 mV
C	*	*				
C	*	*	Tungsten-5%Rhenium vs Tungsten-26%Rhenium	0° to +2200°	——	0 to +29 mV

** Non ASNSI*

amps. The first is configured as a voltage follower which provides a high impedance input, the second, configured as an inverter, provides a –0.62V output from the +6.2 input.

The three potentiometers allow the operator to precisely select the desired calibration voltage as well as provide for an offset adjustment. However, no offset adjustment can be made until the OFFSET potentiometer is enabled.

The power supply/battery charger and battery pack, which are electrically separate from the stable voltage source. The battery pack utilizes sealed, multi-celled, nickel-cadmium rechargeable batteries. Basically, this type of battery is characterized by a flat voltage discharge curve and extremely long cycle life. However, if these batteries are allowed to discharge at a high rate there is a risk of reverse charging also if they are not discharged completely they may develop a memory effect. Memory effect is simply a ni-cad battery that has lost part of its charge capacity due to repeated discharging to the same level. These problems have been overcome by utilizing a load removal circuit and a continuous low level discharge.

The LOW BATTERY indicator (LED) provides a continuous low level discharge (when enabled) as well as an indication of low battery charge. The load removal circuit will automatically remove the load from the battery pack whenever the battery charge drops below a set reference level, thus eliminating the possibility of a high rate discharge. These circuits are described briefly in the following paragraphs.

A reference level, which determines when the load will be disconnected is set by a reference zener. In normal battery operation Q1 is closed, Q2 is open, S1A is closed, S1C is open (charger OFF) and power is being delivered to the load. At this point V1 will be greater than VREF, forcing the output of the comparator U1B low and closing Q1. As the battery discharges Vbatt will become smaller and eventually V1 will equal VREF. Now the comparator U1A opens Q1 and V3 drops to zero. U1B will now close Q2 applying the residual battery voltage across CR1 to ground (eliminating memory effect). CR1 will remain lit until the residual battery voltage drops below the operating voltage of the comparator U1B or below the forward drop of CR1.

To reset the circuit, the user closes S1C which opens S1A and applies charge current to the battery pack. When Vbatt becomes greater than VREF the comparator U1A will close Q1 causing V3 to become greater than VREF. Consequently, U1B will open U2 and the LOW BTRY indicator will turn off.

WARNING

THESE SERVICING INSTRUCTIONS ARE FOR USE BY QUALIFIED PERSONNEL ONLY. TO AVOID ELECTRIC SHOCK, DO NOT PERFORM ANY SERVICING OTHER THAN THAT CONTAINED IN THE OPERATING INSTRUCTIONS UNLESS YOU ARE QUALIFIED TO DO SO.

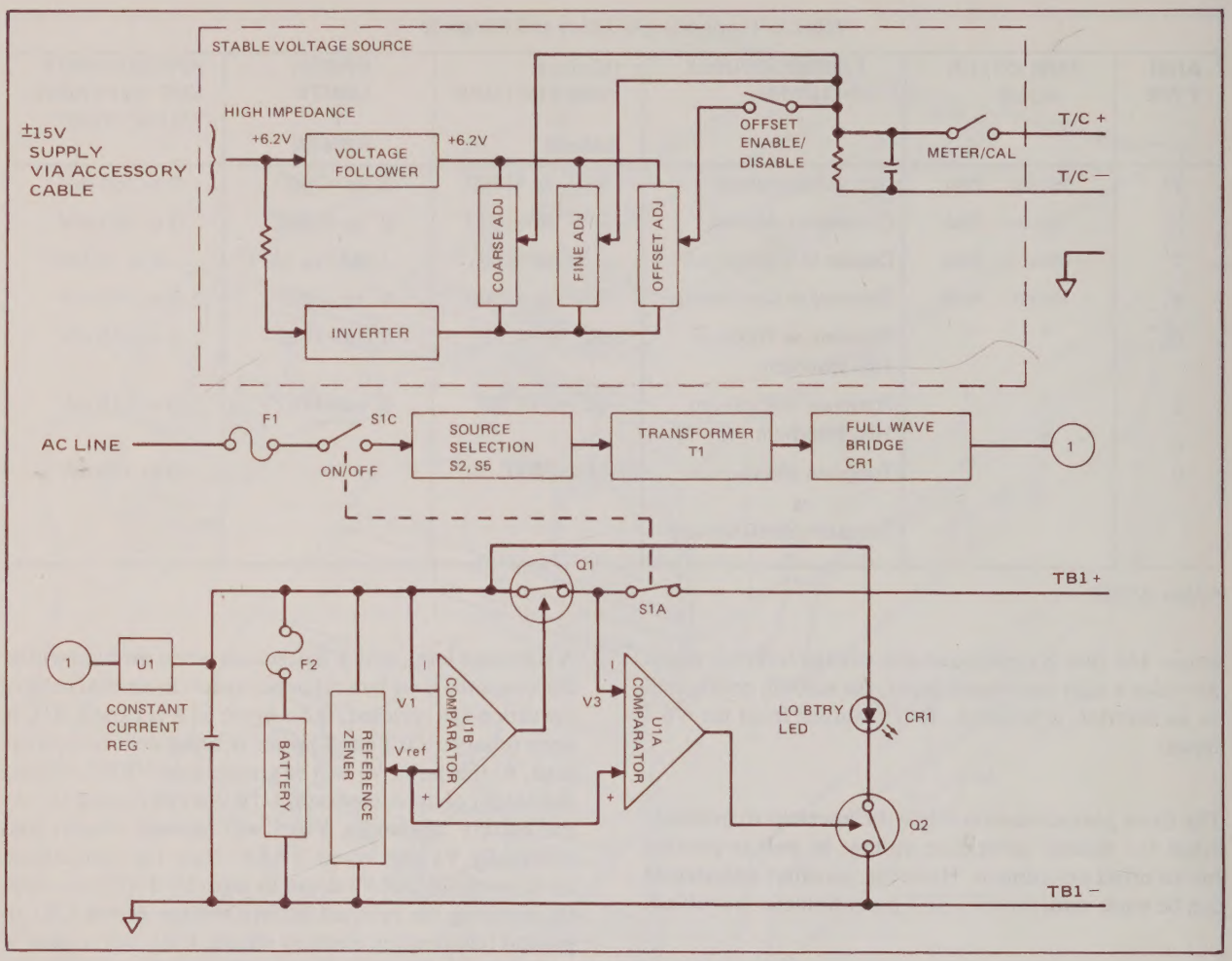


Figure 5. Y2003 Simplified Schematic

GENERAL MAINTENANCE

The following paragraphs provide information about general maintenance, performance testing and troubleshooting. The performance test is recommended when the Y2003 is received and later as a preventive maintenance tool or for testing after repair. Troubleshooting and/or component replacement should be done only if the performance test indicates that is is necessary.

Access Information

To gain access to the interior of the Y2003 simply remove the four #6-32 phillips screws located on the bottom of the instrument and lift the top cover straight up.

Battery Replacement

To Y2003's battery pack consists of 10 ni-cad 1/2 D size cells fully encapsulated in a drip-proof case. These cells are hard wired together, therefore if any cell goes bad the entire battery pack must be replaced, see Parts List for Battery Pack, at the rear of this manual.

PERFORMANCE TEST

Table 3 lists the equipment required for the performance test and troubleshooting. If the recommended model of test equipment is not available, a substitute that meets the minimum specifications may be used. The performance test verifies instrument performance to specifications for initial acceptance or maintenance. The Y2003 requires no calibration, therefore, if the following performance tests cannot be met the operator should complete the troubleshooting procedure.

Calibration Output

The following procedure will determine if the Y2003's variable dc output is operating properly.

Table 3. Recommended Test Equipment

EQUIPMENT NOMENCLATURE	REQUIREMENT	RECOMMENDED EQUIPMENT
Digital Voltmeter (DVM)	5 ½ digit, 1 mV resolution	JF 8800A
Digital Voltmeter (DVM)	5½ digit, 1 mV resolution	JF 8800A
Digital Thermometer	2190A	JF 2190A
Variable Line Source	115V ac ±10% of nominal line voltage	General Radio Variac

1. Place all switches on the Y2003's front panel to the out position and turn the COARSE, FINE and ADJUST potentiometer fully counter-clockwise.

2. Connect the Y2003's ACCESSORY CABLE to the Model 2190A's ACCESSORY CONNECTOR and connect the 2190A to a compatible line source.

3. Remove the 2190A's Thermocouple (if connected) and replace with DVM leads across +TC, -TC on the 2190A input module, see 2190A manual.

4. Energize the DVM and the 2190A, note DVM reads ±10 mV.

5. Turn Y2003's COARSE and FINE potentiometers fully clockwise and note the DVM read ±90 mV.

6. Enable OFFSET ADJUST and note that the offset potentiometer has a range of approximately 100 uV as shown by the DVM.

Battery Charger

The following procedure will determine if the Y2003's battery charger is operating properly.

1. Place all front panel switches on the Y2003 to the out position.

2. Connect the Y2003's +12V dc output to the 2190A's +12V dc input.

3. Energize the 2190A, DO NOT connect the 2190A to a line source. Note that the 2190A's display lights. Allow the Y2003 to power the 2190A until the Y2003's batteries are completely discharged, approximately six hours on a full charge.

4. When batteries are completely discharged connect the Y2003's LINE VOLTAGE CONNECTOR to the variac output. Check Y2003's source selecting switches to insure that Y2003 is compatible with variac output.

5. Decrease variac's output by 10% and depress CHARGER POWER switch to its ON (in) position, note that initially the LO BTRY indicator is lit.

6. If the battery charger is operating properly the LO BTRY indicator will become dimmer and go out in less than 30 minutes. If, however, the indicator remains lit or does not initially light at all, the battery charger will require troubleshooting, see TROUBLESHOOTING.

TROUBLESHOOTING

Troubleshooting guides for the Y2003 are given in Tables 4 and 5. Their completion requires that the Y2003's top cover be removed while the instrument is connected to a line source. It is therefore recommended that only qualified personnel perform the following troubleshooting procedure.

Line Voltage Points

When troubleshooting the Y2003 the technician should be aware that the following points will be at line potential.

1. Rear Panel LINE VOLTAGE CONNECTOR.

2. Fuses F1, F2.

3. Primary on transformer, T1, and associated land patterns.

4. Source selecting switches S2, S5 and associated land patterns.

5. CHARGER POWER switch S1.

Set-Up Procedure

The following steps are intended to help the technician determine that the fault actually exists within the Y2003. These steps should be completed before any troubleshooting is begun.

1. Is Y2003's ACCESSORY CABLE properly connected to a working 2190A?

2. Are Y2003's fuses (F1 and F2) OK?

3. Is Y2003 and 2190A connected to a compatible line source?

4. Are Y2003's METER/CAL and POWER CHARGER switch in the correct position for the desired operation?

PARTS LIST

A detailed parts breakdown for the Y2003 is provided in Table 6. Refer to Section 5 of the 2190A Instruction Manual for specific parts ordering information.

Table 4. Y2003 Calibrator Output Troubleshooting

STEP NO.	ACTION	Go to the step number given for correct response	
		YES	NO
1	Has the Calibrator Output Performance Test been completed?	3	2
2	Complete Performance Test.		
3	Has the Troubleshooting set up procedure been completed?	5	4
4	Complete set up procedure.		
5	Remove Y2003 top cover and check voltage on U3-7, U4-7, for +15V dc ±5%.	7	6
6	Check input from 2190A.		
7	Check U3-4, U4-4 for −15V dc ±5%.	8	6
8	Does calibrator output meet specifications?	18	9
9	Check U3-3, for 6.2V dc ±5%.	11	10
10	Check R11, R12 and V2, replace if necessary.		
11	Check U3-6 for 6.2V dc ±5%.	13	12
12	Check U3, R15, R16, R7, replace as required.		
13	Check U4-6 for −0.7V dc.	14	15
14	Check R15, R16, R7, replace if necessary.		
15	Replace U4.		
16	Does Calibrator Output meet specifications?	18	17
17	Check R18, R19, R20 and C3, replace if necessary.		
18	Calibrator is functional.		

Table 5. Y2003 Battery Charger Troubleshooting

STEP NO.	ACTION	Go to the step number given for correct response	
		YES	NO
1	Has Battery Charger Performance Test been completed?	3	2
2	Complete Battery Charger Performance Test.		
3	Has the Troubleshooting set up procedure been completed?	5	4
4	Complete troubleshooting set up procedure.		
5	Turn CHARGER POWER switch ON (in) and remove Y2003 top cover.		
6	Check voltage across R1, is it approximately 1.2V dc?	8	7
7	Check input power supply, U1 and CR2, replace if necessary. Go back to step 6.		
8	Check voltage on collector of Q2, is it approximately 12V dc?	10	9
9	Check voltage on U2-2, is it greater than or equal to the voltage on U2-3?	11	10
10	Check R22, CR3, U2, R4 and C4, replace if necessary.		
11	Check U2, replace if necessary.		
12	Check voltage on collector of Q2, is it approximately 12V dc?	14	13
13	Check Q1, R5 and Q2, replace if necessary. *NOTE* *To verify proper operation of the LO BTRY indicator (CR4) connector a jumper across R9, the indicator should light up. If not, check U2, Q3, R10, CR4 and its' connection, replace as required.*		
14	Battery Charger is now functional.		

Table 6. Model Y2003 Calibrator

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
	MODEL Y2003 CALIBRATOR	ORDER	MODEL	Y2003 CALIBRATOR	1		
A1	CHASSIS ASSEMBLY(2190A-4270)	ORDER	MODEL	Y2003 CALIBRATOR	1		
F1	FUSE,1/16 AMP,FAST ACTING	109348	71400	AGC1-16 2	1	5	
	FUSE,1/8 AMP,250V	196790	71400	AGC1-8 1	1	5	
F2	FUSE,3/4 AMP,FAST ACTING	109249	71400	AGC1-8	1	5	
H1	SCREW,6-32 X 5/8,FHP	114876	73734	18247	4		
W1	CORD SET(NOT SHOWN)	284174	89536	284174	1		

1 FOR 100/120V UNIT OPERATION USE ITEM F1-1,1/8 AMP FUSE. DISCARD ITEM F1,1/16 FUSE.

2 FOR 250V UNIT OPERATION USE F1,1/16 AMP FUSE. DISCARD F1-1,1/8 AMP FUSE.

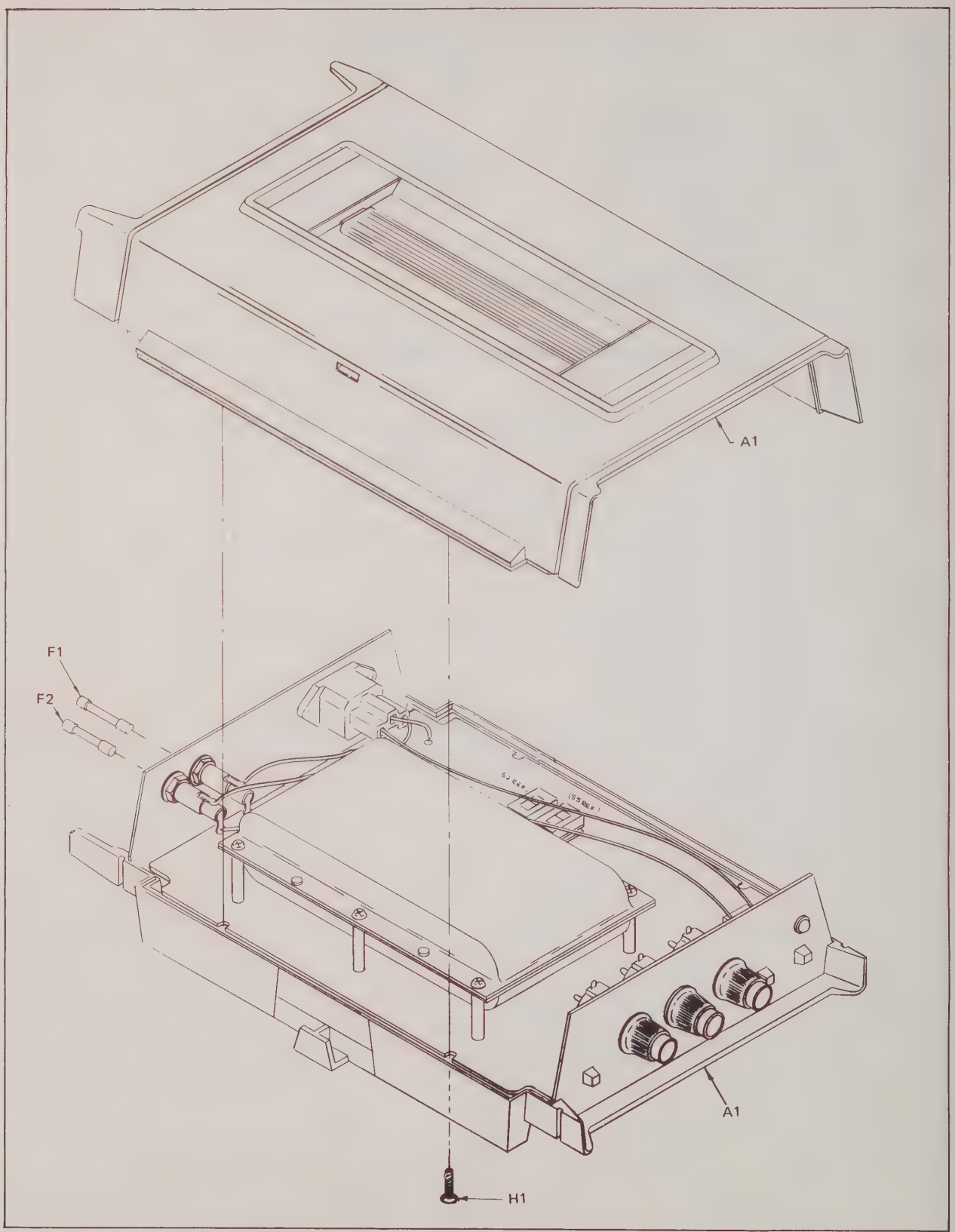


Figure 6. Model Y2003 Calibrator

Table 7. A1 Chassis Assembly

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
A1	CHASSIS ASSEMBLY(2190A-4270)	ORDER	MODEL	Y2003 CALIBRATOR	1		
A1A1	CALIBRATOR ASSEMBLY(2190A-4070T)	ORDER	MODEL	Y2003 CALIBRATOR	1		
A1A2	BATTERY PACK ASSEMBLY(2190A-4202)	472365	89536	482365	1		
CR4	DIODE,LED	428623	12040	59NSL-5046	1	1	
H1	SCREW,6-20 X 3/8	288266	89536	288266	1		
H2	SCREW,PHP 6-32 X 3/8	385401	73734	23042	6		
H3	SCREW,FHP 6-32 X 5/8	335158	73734	22247	2		
MP1	BASE STANDARD	454702	89536	454702	1		
MP2	GUARD,BASE	464404	89536	464404	1		
MP3	LATCH,PTI	467548	89536	467548	2		
MP4	BAIL,PTI	467555	89536	467555	1		
MP5	FOOT,NONSKID	467571	89536	467571	4		
MP6	DECAL,FRONT PANEL	473959	89536	473959	1		
MP7	REAR PANEL	475251	89536	475251	1		
MP8	FRONT PANEL	475053	89536	475053	1		
MP9	DECAL,BASE SIDES	473652	89536	473652	2		
MP10	DECAL,BOTTOM	473942	89536	473942	1		
MP11	KNOB ASSEMBLY	341388	89536	341388	3		
MP12	FUSE HOLDER CAP	460238	89536	460238	2		
MP13	COVER,"B" SIZE	454728	89536	454728	1		
MP14	GUARD COVER "B"	464172	89536	464172	1		
MP15	HANDLE,RETAINER	467563	89536	467563	2		
MP16	DECAL,RETAINER	473645	89536	473645	2		
MP17	HANDLE,PTI	454751	89536	454751	1		
R15	RES,VAR,1K +/-3%,2W	461905	32997	3500-S-1-102	1		
R16	RES,VAR,10K +/-3%,2W	461913	32997	3500-S-1-103	2		
R17	RES,VAR,10K +/-3%,2W	461913	32997	3500-S-1-103	REF		
W1	CABLE ASSEMBLY	475228	89536	475228	1		
XF1	FUSE HOLDER	375188	89536	375188	2		

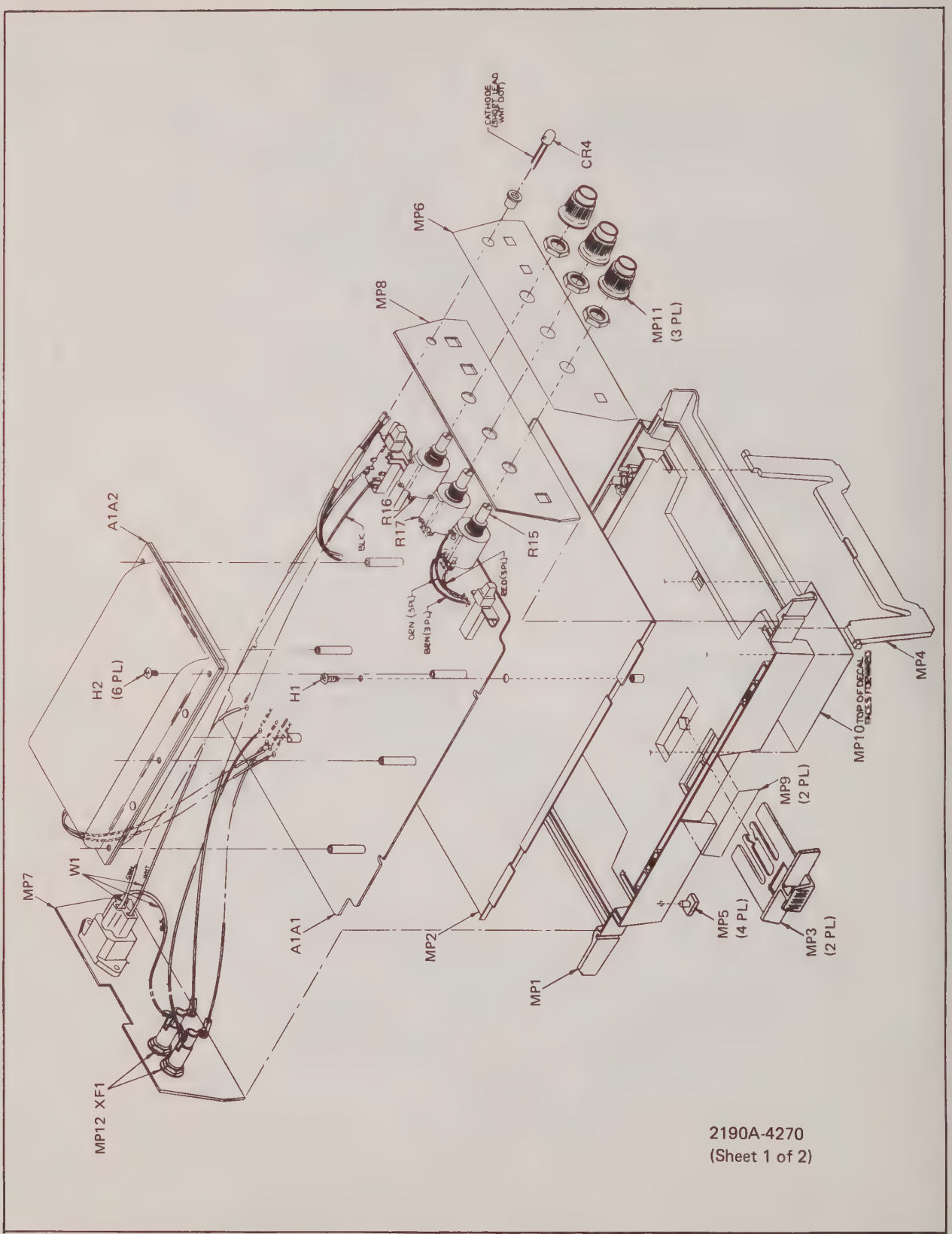
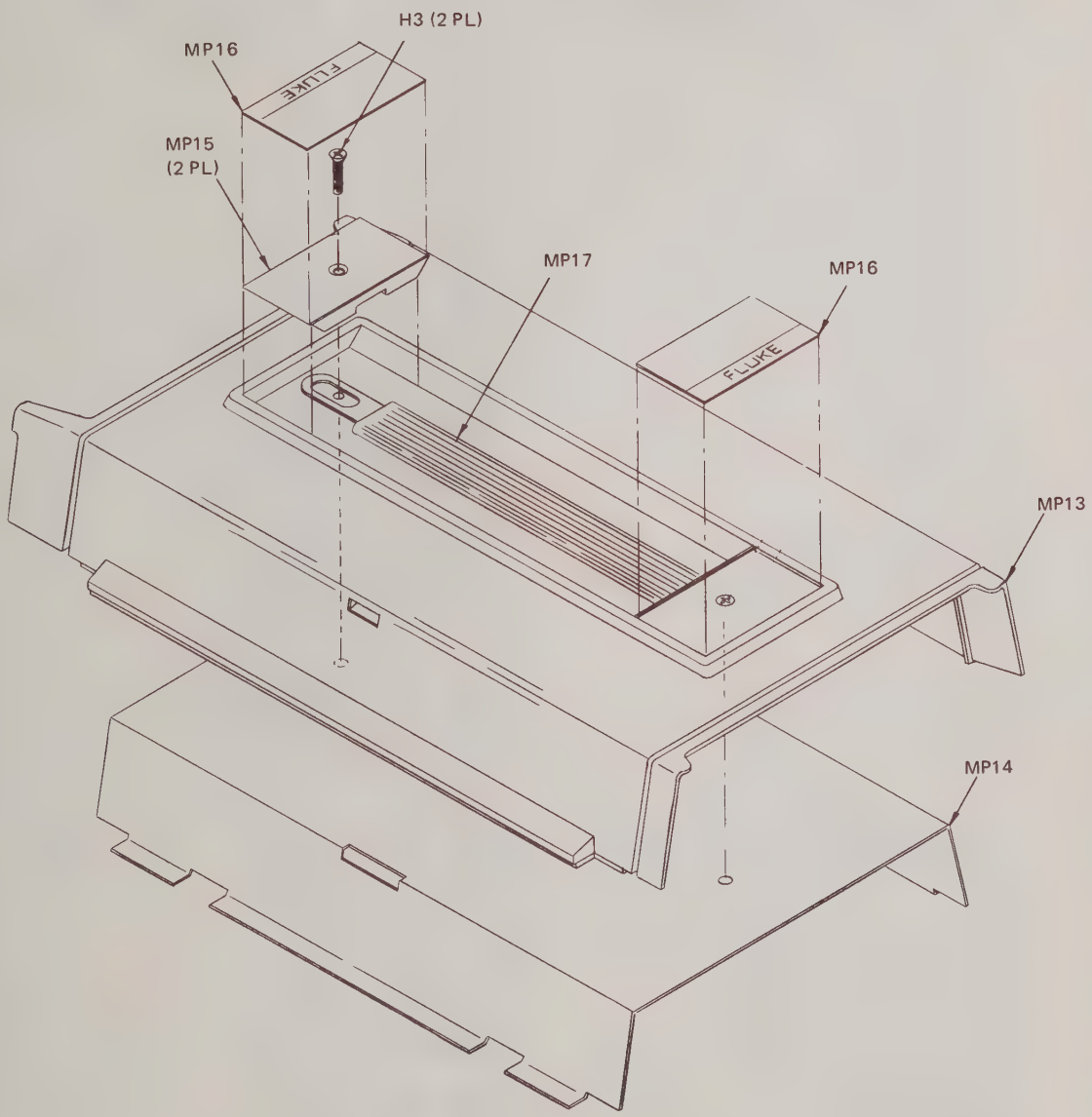


Figure 7. A1 Chassis Assembly



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(Sheet 2 of 2)

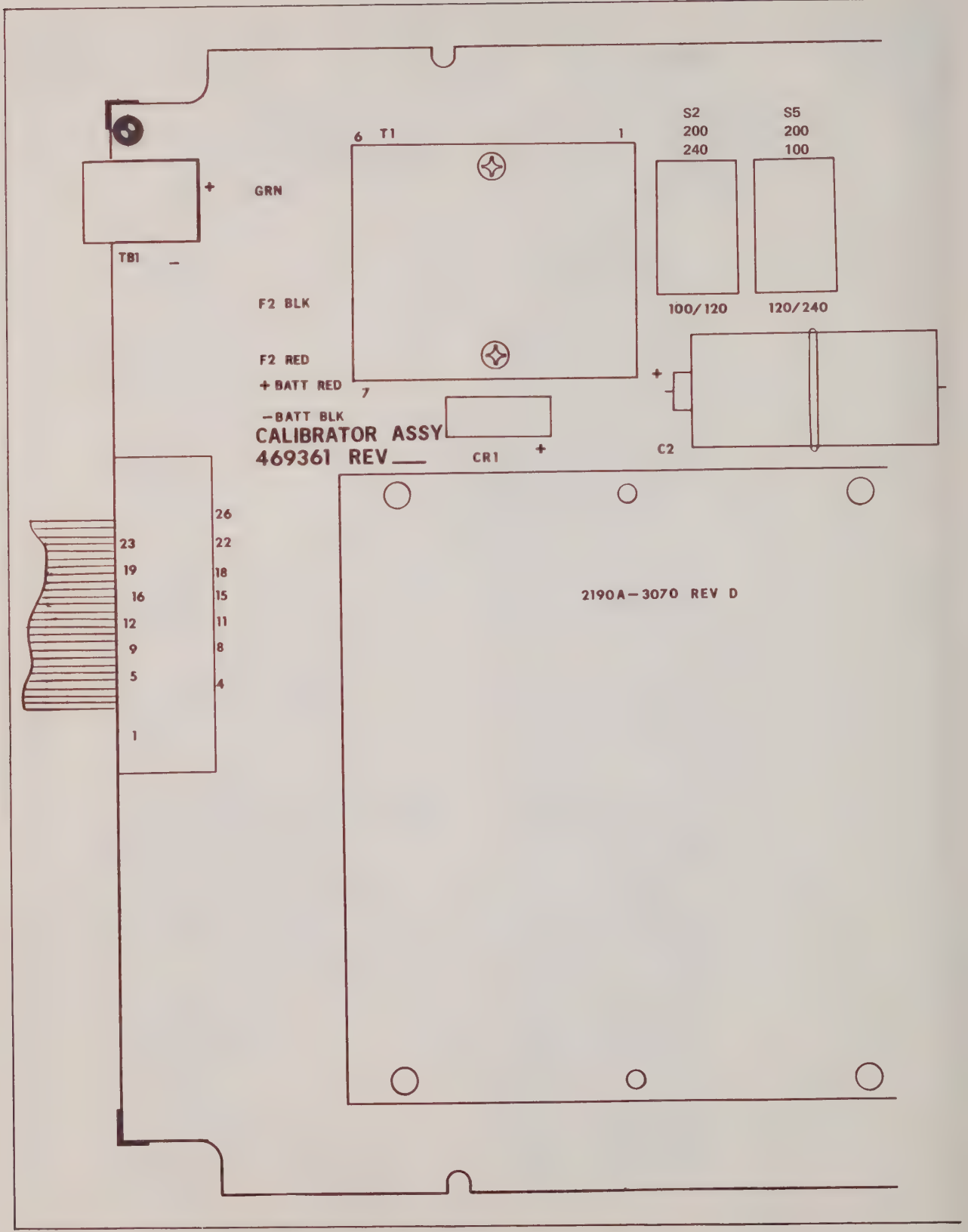
Figure 7. A1 Chassis Assembly (cont.)

Table 8. A1A1 Calibrator Assembly

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
A1A1	CALIBRATOR ASSEMBLY(2190A-4070T)	ORDER	MODEL	Y2003 CALBRATOR	1		
C1	CAP MICA,33PF +/-5%,500V	160317	72136	DM15E330J	1		
C2	CAP,ELECT,470UF -10/+100%,40V	403030	80031	3050FJ501U050	1	1	
C3	CAP,POLYSTR,0.47UF +/-10%, 100V	369124	73445	C280MAH/A470K	1		
C4	CAP,TA,10UF +/-20%,20V	330662	56289	196D106X0020KA1	1		
CR1	RECTIFIER BRIDGE	392910	09423	FB100	1	1	
CR2	DIODE,SI,RECT	343491	01295	IN4002	1	1	
CR3	DIODE,ZENER	393579	07910	IN4567	1	1	
H1	RUBBER STRAP	104794	98159	2829-115-3	1		
H2	SCREW,PNH,4-40 X 1/4	256156	73734	23022	1		
H3	NUT,HEX,4-40	110635	73734	8003N	1		
H4	WASHER,LCK,SPLIT,#4	185710	89536	185710	1		
H5	SCREW,PNH,4-40 X 1/2	156380	73734	19033	2		
MP1	HEATSINK	414128	13103	6030B-TT	1		
MP2	SWITCHBUTTON GREEN	445197	89536	445197	1		
MP3	SWITCHBUTTON	425900	89536	425900	2		
MP4	PRESSNUT	380196	24347	KF2-440	2		
P5	CABLE ASSEMBLY	473439	89536	473439	1		
Q1	XSTR,SI,PNP	195974	04713	2N3906	2	1	
Q2	XSTR,SI,PNP	478214	89536	478214	1		
Q3	XSTR,SI,PNP	195974	04713	478214	REF		
R1	RES,COMP,6.2 +/-5% 1/2W	218750	01121	EB62G5	1		
R2	RES,VAR,1K +/-10%, 1/2W	285155	89536	285155	1	1	
R3	RES,MF,14.3K +/-1%, 1/8W	291617	91637	CMF551432F	1		
R4	RES,MF,26.7K +/-1%, 1/8W	245779	91637	CMF552672F	1		
R5	RES,DEP CAR,680 +/-5%, 1/4W	368779	80031	CR251-4-5P680ET	1		
R6	RES,MF,6.65K +/-1%, 1/8W	294918	91637	CMF556651F	1		
R7	RES,MF,10K +/-1%, 1/8W	168260	91637	CMF551002F	2		
R8	RES,MF,7.68K +/-1% , 1/8W	370999	91637	CMF557681F	1		
R9	RES,MF,10K +/-1%, 1/8W	168260	91637	CMF551002F	REF		
R10	RES,DEP CAR,1K +/-5%, 1/4W	343426	80031	CR251-4-SP1KT	1		
R11	ZENER REFERNECE SET(R11,R12 AND VR2)	377283	89536	377283	1		
R12	ZENER REFERNECE SET(R11,R12 AND VR2)	377283	89536	377283	REF		
R13	RES,MF,61.9K +/-1%, 1/8W	237230	91637	CMF556192F	1		
R14	RES,MF, 6.81K +/-1%, 1/8W	268417	91637	CMF556811F	1		
R18	RES,WW,6200 +/-170% , 1/8W	461921	89536	461921	1	1	
R19	RES,COMP,2M +/-5%, 1/4W	268771	01121	CB2055	1		
R20	RES,COMP,1M +/-5%, 1/4W	182204	01121	CB1055	1		
R21	RES,WW,100 +/-1%, 1/8W	461939	89536	461939	1	1	
R22	RES,MF,2.74K +/-1%, 1/8W	293761	91637	CMF552741F	1		
S1-S3	SWITCH ASSEMBLY	473348	89536	473348	1		
S2	SWITCH,SLIDE,DPDT	234278	82389	XW1649	2		
S4	SWITCH ASSEMBLY	473454	89536	473454	1		
S5	SWITCH,SLIDE,DPDT	234278	82389	XW1649	REF		
T1	TRANSFORMER	464388	89536	464388	1		
TB1	TERMINAL BLOCK	479006	89536	479006	1		
U1	IC,LIN,ADJ,VREG	460410	01295	LM317KC	1		
U2	IC,LIN,LO-PWR,DUAL VOL COMPTR	478354	01295	LM393N	1		
U3	IC,LIN,OP-AMP	413740	12040	LM307N	1		
U4	IC,OP-AMP	225961	24355	AD3092	1		

Table 8. A1A1 Calibrator Assembly (cont.)

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
VR2	ZENER REFERNECE SET(R11,R12 AND VR2)	377283	89536	377283	REF		
W1	CABLE ASSEMBLY	480905	89536	480905	1		
W2	POT CABLE	489286	89536	489286	3		


S2
200
240
S5
200
100
6 T1 1
+
GRN
TB1 –
F2 BLK
F2 RED
+BATT RED
7
–BATT BLK
CALIBRATOR ASSY
469361 REV ___
CR1
+
100/120
120/240
+
C2
26
23
22
19
18
16
15
12
11
9
8
5
4
1
2190A–3070 REV D

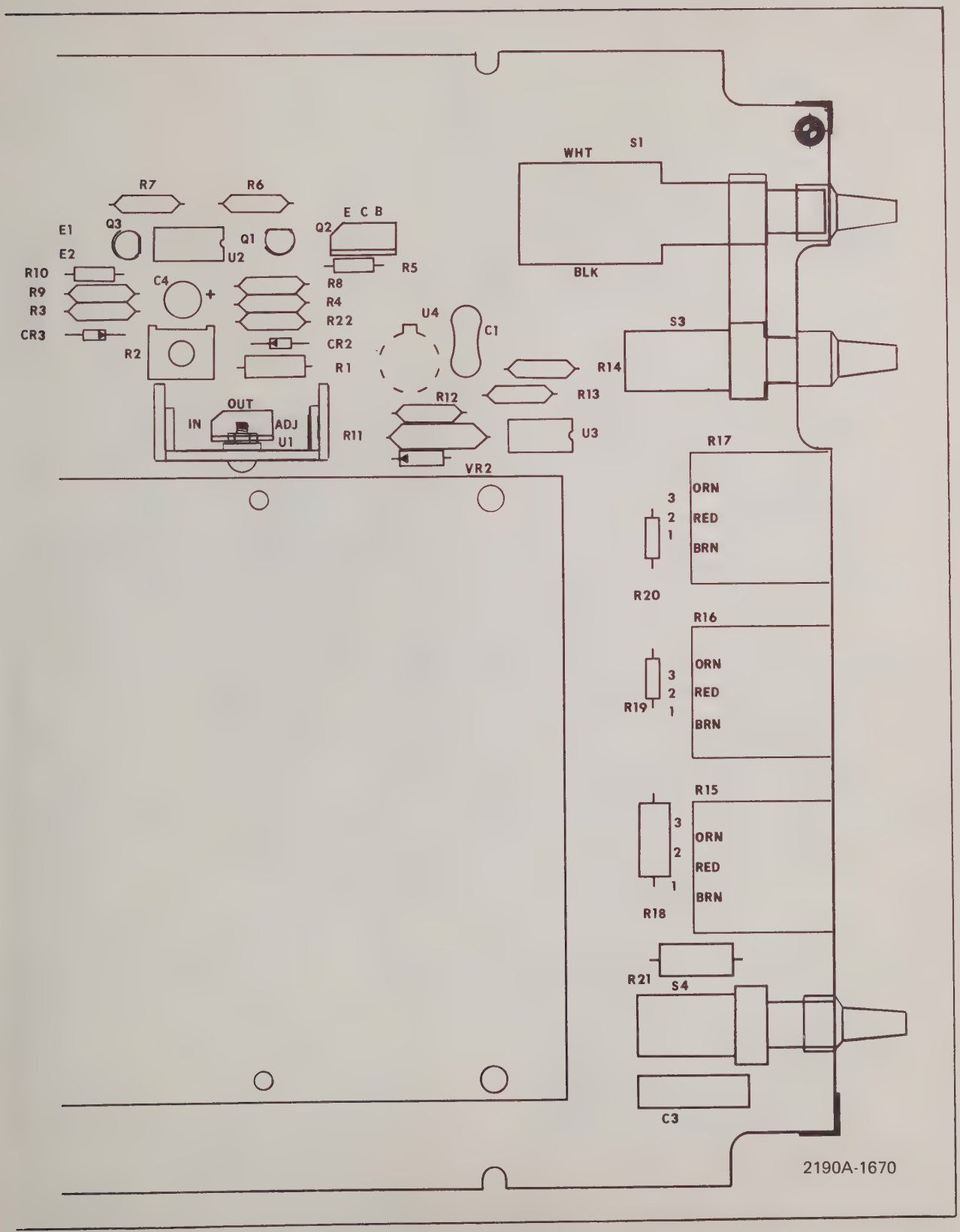
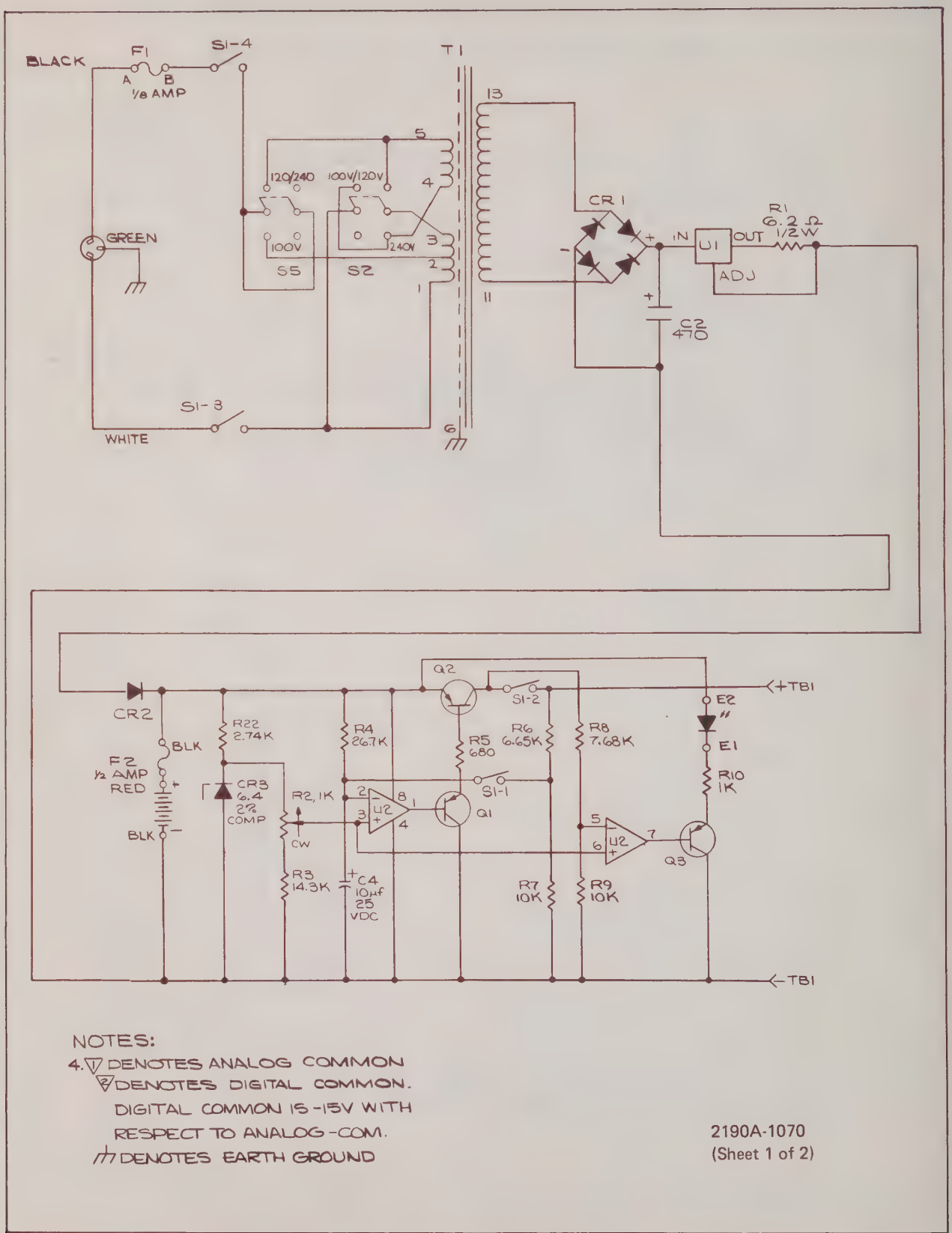


Figure 8. A1A1 Calibrator Assembly



NOTES:

4. ▽ DENOTES ANALOG COMMON
   ▽ DENOTES DIGITAL COMMON.
   DIGITAL COMMON IS -15V WITH RESPECT TO ANALOG-COM.
   ⏚ DENOTES EARTH GROUND

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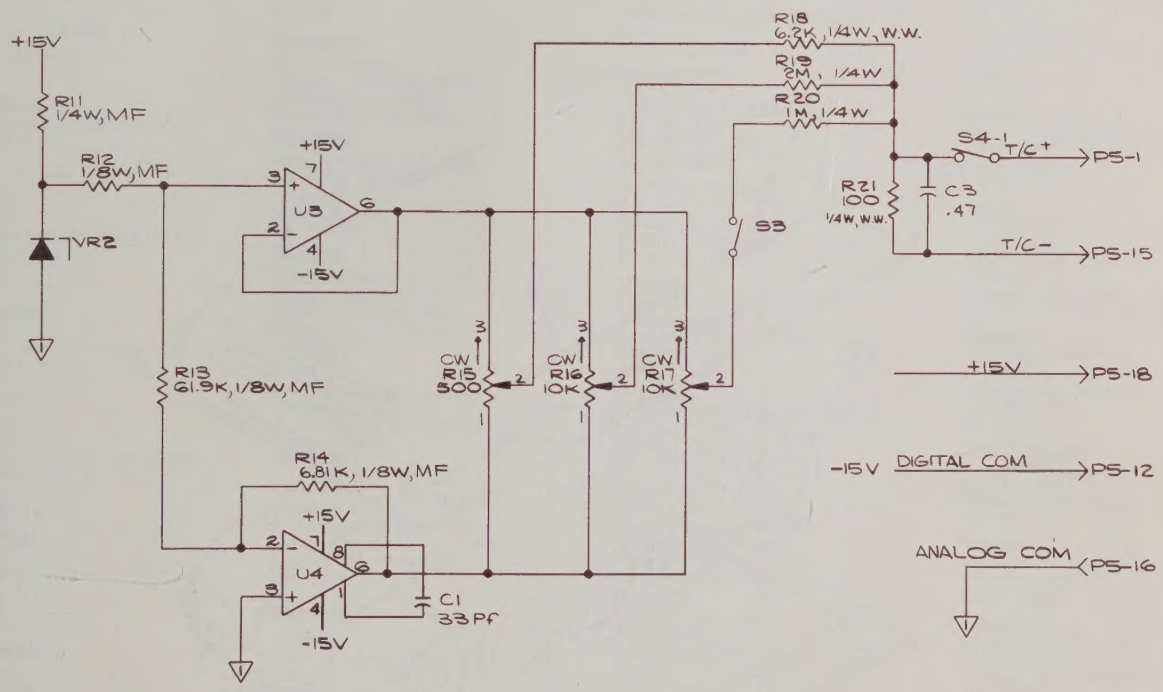
Figure 8. A1A1 Calibrator assembly (cont.)



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(Sheet 2 of 2)

Figure 8. A1A1 Calibrator Assembly (cont.)

Table 9. A1A2 Battery Pack Assembly

ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	USE CDE
A1A2	BATTERY PACK ASSEMBLY(2190A-4202)	472365	89536	472365	1		
B1	BATTERY,RECHARGEABLE	479147	06001	PPS7W092	1		
H1	RIVET, .1205 X 5/32	103424	12014	R3647X5-32	4		
MP1	BATTERY,HOLDER	476168	89536	476168	2		
MP2	FOAM SPACER	476150	89536	476150	1		

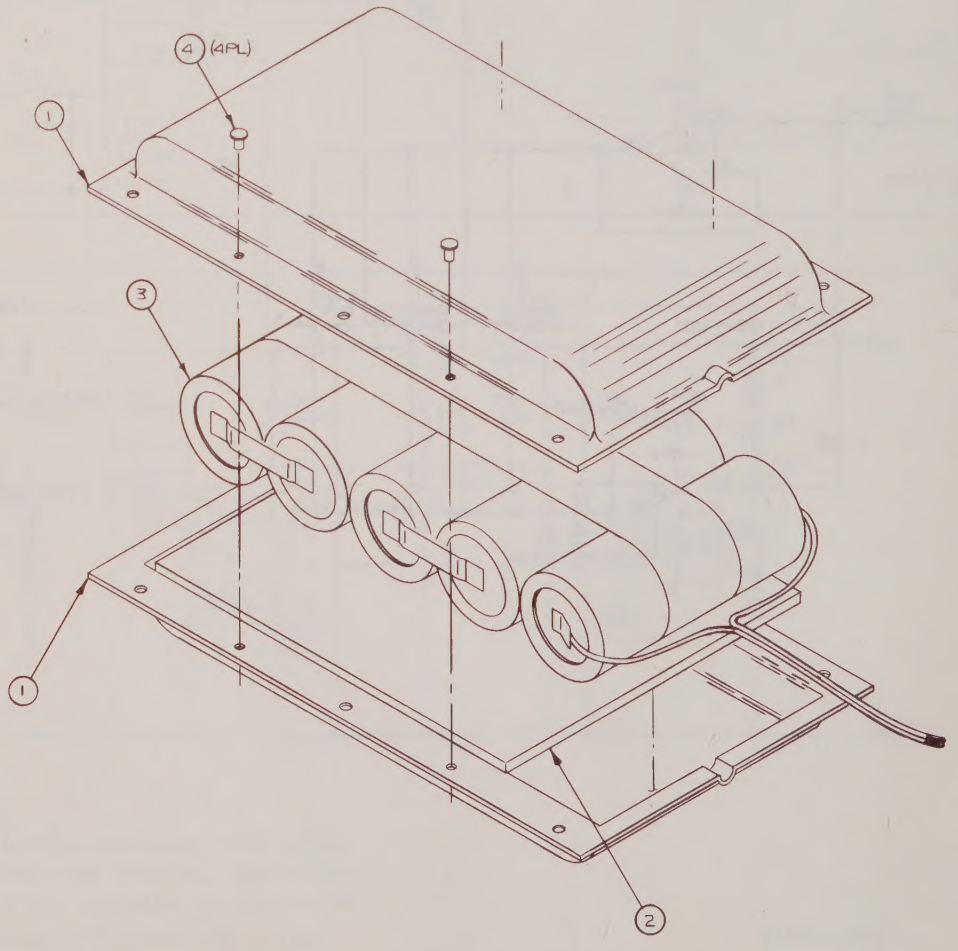

Figure 9. A1A2 Battery Pack Assembly

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